Weather and Climate

Death Valley National Park

◆ **Death Valley is famous as the hottest, driest and lowest place in North America.**

◆ **Higher elevations are cooler than the low valley. Temperatures drop 3° to 5° F with every thousand vertical feet.**

◆ **Sunny skies are the norm in Death Valley, but winter storms and summer monsoons can bring cloud cover and rain.**

◆ **Wind is common in the desert, especially in the spring. Dust storms can suddenly blow up with approaching cold fronts.**

◆ **Weather data was compiled from park and National Weather Service record summaries for the years 1911 through 2006 for Furnace Creek in Death Valley, California.**

Temperatures and Precipitation

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
daily high (average)	**65° F** 18° C	**72° F** 22° C	**80° F** 27° C	**90° F** 32° C	**99° F** 37° C	**109° F** 43° C	**115° F** 46° C	**113° F** 45° C	**106° F** 41° C	**92° F** 33° C	**76° F** 24° C	**65° F** 18° C	**90° F** 32° C
daily low (average)	**39° F** 4° C	**46° F** 8° C	**53° F** 12° C	**62° F** 17° C	**71° F** 22° C	**80° F** 27° C	**88° F** 31° C	**85° F** 29° C	**75° F** 24° C	**62° F** 17° C	**48° F** 9° C	**39° F** 4° C	**62° F** 17° C
record high	**89° F** 32° C	**97° F** 36° C	**102° F** 39° C	**112° F** 45° C	**122° F** 50° C	**128° F** 53° C	**134° F** 57° C	**127° F** 53° C	**123° F** 50° C	**113° F** 45° C	**97° F** 36° C	**88° F** 31° C	**134° F** 57° C
record low	**15° F** -9° C	**25° F** -4° C	**30° F** -1° C	**35° F** 2° C	**42° F** 6° C	**49° F** 10° C	**62° F** 17° C	**64° F** 18° C	**41° F** 5° C	**32° F** 0° C	**24° F** -4°C	**19° F** -7° C	**15° F** -9° C
precipitation	**.27"** 0.7 cm	**.35"** 0.9 cm	**.25"** 0.6 cm	**.12"** 0.3 cm	**.08"** 0.2 cm	**.04"** 0.1 cm	**.11"** 0.3 cm	**.10"** 0.3 cm	**.14"** 0.4 cm	**.11"** 0.3 cm	**.18"** 0.5 cm	**.19"** 0.5 cm	**1.94"** 4.9 cm

Changing rainfall patterns

Yearly precipitation consistantly averaged about 1.6 inches of rain for the first 65 years of record keeping. The last 30 years has seen an increase, averaging 2.5 inches of rain a year. The 95-year average is now just under two inches a year.

Longest summers

The greatest number of consecutive days with a maximum temperature of 100° F or above was 154 days in the summer of 2001. The summer of 1996 had 40 days over 120° F, and 105 days over 110° F. The summer of 1917 had 43 consecutive days with a high temperature of 120° F or above.

The highest ground temperatures

The highest ground temperature recorded was 201° F at Furnace Creek on July 15, 1972. The maximum air temperature for that day was 128° F. Ground temperature on the valley floor is about 40% higher than the surrounding air temperature.

Why is Death Valley's climate so extreme?

Why so Dry?

Winter storms moving inland from the Pacific Ocean must pass over mountain ranges to continue east. As the clouds rise up they cool and the moisture condenses to fall as rain or snow on the western side of the ranges. By the time the clouds reach the mountain's east side they no longer have as much available moisture, creating a dry "rainshadow".

Four major mountain ranges lie between Death Valley and the ocean, each one adding to an increasingly drier rainshadow effect.

Why so hot?

The depth and shape of Death Valley influence its summer temperatures.

The valley is a long, narrow basin 282 feet (86 m) below sea level, yet is walled by high, steep mountain ranges.

The clear, dry air and sparse plant cover allow sunlight to heat the desert surface. Heat radiates back from the rocks and soil, then becomes trapped in the valley's depths. Summer nights provide little relief as overnight lows may only dip into the 85°F to 95°F (30°C to 35°C) range.

Heated air rises, yet is trapped by the high valley walls, is cooled and recycled back down to the valley floor. These pockets of descending air are only slightly cooler than the surrounding hot air. As they descend, they are compressed and heated even more by the low elevation air pressure. These moving masses of super heated air blow through the valley creating extreme high temperatures.

Weather Landmarks:

1911 Permanent weather station established at Greenland Ranch now known as Furnace Creek Ranch.

1913 4.54 in. (11.5 cm) of rain held calendar year record 92 years. **Coldest temperature:** 15° F (-10°C) recorded on January 8. **Hottest temperature:** 134° F (57°C) recorded on July 10 - five consecutive days reach 129° F (54°C) or above. Held record for the hottest place on earth until 1922.

1917 52 days 120° F (49°C)or above with 43 of them consecutive.

1922 1/2 inch (1.3 cm) of snow, January 29.

1922 136° F (58°C) at Azizia, Libya in the Sahara Desert. Current world record high temperature.

1929 No rain recorded.

1931-34 Driest stretch on record - 0.64 inches (1.6cm) of rain over a 40-month period.

1933 Official park weather station established at Cow Creek, 3 mi. north of Furnace Creek.

1953 No rain recorded at Greenland Ranch.

1960 129° F (54°C) recorded on July 18 at Greenland Ranch.

1961 Official weather station opens at new Furnace Creek Visitor Center. Cow Creek and Greenland Ranch stations close.

1976 Floods wash out Golden Canyon Road - record five day February storm brings 2.37 inches (6.0 cm) of rain.

1977-78 5.09 inches (12.9 cm) of rain - rainy season record until 1987-88.

1978 Spectacular wildflower bloom.

1983 4.54 inches (11.5 cm) of rain.

1984 Summer floods close park roads for several weeks - 4.04 inches (10.3 cm) of rain for year.

1987-88 5.43 inches (13.8 cm) of rain - rainy season record until 1997-98.

1995 Wettest month ever recorded in Death Valley - 2.59 inches (6.6 cm) of rain in January.

1996 Hottest summer on record - 40 days over 120° F (49°C).

1997-98 6.09 inches (15.5 cm) of rain.

1998 129° F (54°C) on July 17. Spectacular wildflower bloom.

2001 154 days in a row of 100° F (38°C) or above.

2004 August floods kill two and close park for nine days. Some roads are closed for months.

2004-05 6.44 inches (16.4 cm) of rain. Wettest rainy season (July-June) on record.

2005 129° F (54°C) on July 19. 4.73 inches (12.0 cm) of rain- breaks 92-year old calendar year (Jan.-Dec.) record. Spectacular wildflower bloom.

2007 129° F (54°C) on July 6.

rev.7/07

Geology

Death Valley National Park

Death Valley National Park is a 3.3 million-acre preserve which show-cases the subtle beauty and uniqueness of desert environments. What events conspired to create Death Valley? Why is the landscape so varied, and so extreme? Badwater Basin contains the lowest point in North America, at 282 feet below sea level, yet it lies in the afternoon shadow of 11,049-foot Telescope Peak. This rugged topography, as well as sand dunes, craters, and flood-carved canyons, indicate that Death Valley has experienced a lengthy and complex geologic history.

Ancient Seas

Death Valley's rocks, structure and landforms offer a wealth of information about what the area may have looked like in the past. It is apparent that there has not always been a valley here. Death Valley's oldest rocks, formed at least 1.7 billion years ago, are so severely altered that their history is almost undecipherable. Rocks dating from 500 million years ago, however, paint a clearer picture. The limestones and sandstones found in the Funeral and Panamint Mountains indicate that this area was the site of a warm, shallow sea throughout most of the Paleozoic Era (542 - 251 million years ago.)

Warped Mountains

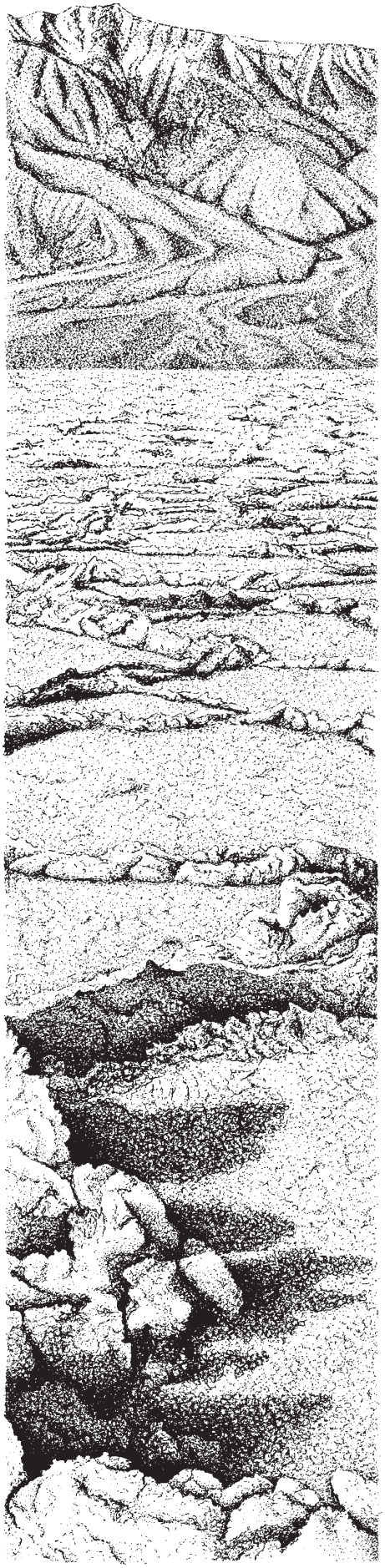
Time passed and the sea began to slowly recede to the west as land was pushed up. This uplift was due to movement occurring far beneath the Earth's surface. Scientists have discovered that the Earth's crust is composed of inter-connected sections, or plates. Death Valley lies near the boundary between two of these plates. As the plates slowly move in relation to each other, compressional forces gradually fold, warp and fracture the brittle crust. This widespread rock deformation and faulting occurred through most of the Mesozoic Era (251 - 65.5 million years ago.) While the Rocky Mountains and the Sierra Nevada formed, active mountain building alternated with times when erosion prevailed, worked to breaking down the mountains that had formed.

salt-fractured boulder

flood-polished marble in Mosaic Canyon

Traveling Volcanoes

The next phase in Death Valley's development was primarily influenced by volcanic activity that spanned much of the Tertiary Period (65.5 - 2 million years ago.) As fault movement and mountain building stretched the land surface, the crust was weakened. Hot, molten material beneath the surface welled up and erupted at these weak points. The seething volcanoes first appeared to the northeast, in Nevada, and blanketed the Death Valley region with numerous layers of ash and cinders. The topography then consisted of gently rolling hills, perhaps simular to the present-day Skidoo area. Over time, the center of volcanic activity moved progressively westward, finally producing a chain of volcanoes from Furnace Creek to Shoshone, burying the ancient rocks of the Black Mountains. Secondary results of the ash and cinder eruptions include the vivid colors of the Artist's Palette and Death Valley's famous borate mineral deposits.



Badwater Basin and Telescope Peak

Basin and Range

Approximately three million years ago, the dynamics of crustal movement changed, and Death Valley proper began to form. At that time, compression was replaced by extensional forces. This "pulling apart" of Earth's crust allowed large blocks of land to slowly slide past one another along faults, forming alternating valleys and mountain ranges. Badwater Basin, the Death Valley salt pan and the Panamint mountain range comprise one block that is rotating eastward as a structural unit. The valley floor has been steadily slipping downward, subsiding along the fault that lies at the base of the Black Mountains. Subsidence continues today. Evidence of this can be seen in the fresh fault scarps exposed near Badwater.

Erosion and Deposition

Concurrent with the subsidence has been slow but continuous erosion. Water carries rocks, gravel, sand and silt down from surrounding hills and deposits them on the valley floor. Beneath Badwater lies more than 11,000 feet of accumulated sediment and salts.

Lost Lakes

In addition to structural changes, Death Valley has been subjected to major climatic changes throughout the past three million years. During North America's last major Ice Age, the valley was part of a system of large lakes. The lakes disappeared approximately 10,000 years ago, evaporating as the climate warmed. As the lakes evaporated, vast fields of salt deposits were left behind. A smaller, now vanished, lake system occupied the basin floor about 3000 years ago.

Yesterday's Volcano

Signs of recent volcanic activity exist in northern Death Valley at Ubehebe Crater. Caused by violent steam explosions, the craters formed as recently as 300 years ago when hot, molten material came in contact with groundwater. These large depressions show that Death Valley's geology is dynamic and ever changing .

Ubehebe Crater

Shape of the Future

Death Valley's landscape has been changing for millions of years. It is changing now, and will continue to change long after we have departed. Erosion slowly carves away at the ancient rock formations, reshaping the surface of the land. The basin continues to subside and the mountains rise ever higher. It is interesting to imagine, but impossible to predict, the future of Death Valley. During your visit here, take time to explore the canyons, salt flats, dune fields and mountains See if you, too, can unlock secrets of Death Valley's long and colorful geologic history.

Common Desert Plants

Death Valley National Park

The low desert of Death Valley is a harsh place for plants to survive. The combination of high summer temperatures, an average annual rainfall of less than 2 inches, and concentrations of salts in the soil all account for the sparse vegetation found here. These plants have been sucessful at enduring the hardships and are the most common in the low elevations of Death Valley National Park.

Honey Mesquite

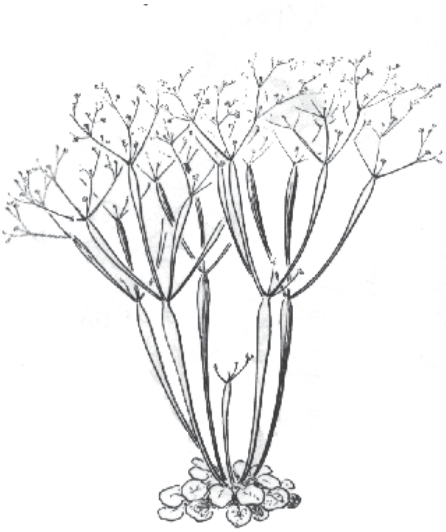
Prosopis glandulosa torreyana

Small native tree of watered areas.

LEAVES: divided and fern-like; deciduous

BRANCHES: knobby; long spines

FRUIT: straw-colored, edible pod



Desert Trumpet

Eriogonum inflatum

Odd plant 1 to 3 feet tall of road-sides and washes.

LEAVES: silver-green; at base of plant

FLOWERS: yellow and tiny

STEMS: flower stalks have hollow bulge just below branches

Sprucebush

Peucephyllum schottii

Dark green shrub of washes or canyons.

LEAVES: needle shaped leaves resemble conifer; pine scented

FLOWERS: yellow clusters

BRANCHES: twisted “trunk” like a juniper

Desert Holly

Atriplex hymenelytra

Stout shrub of alluvial fans, foot-hills, and washes.

LEAVES: whitish, smooth leaves are holly-shaped; turns pink in summer when dormant

FLOWERS: pink bud clusters are berry-like; wind pollinated

Creosotebush

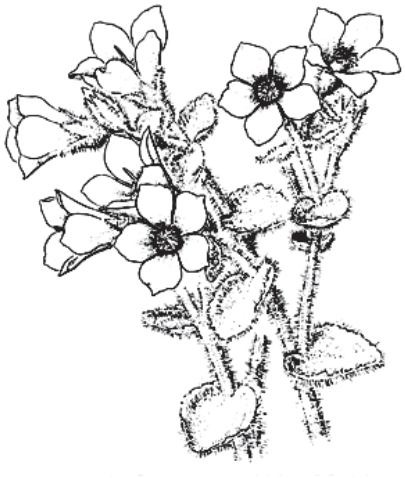
Larrea tridentata

Delicate-looking yet hardy shrub with strong odor of creosote.

LEAVES: olive-green, tiny and "cleft" into 2 segments

FLOWERS: yellow with 5 petals

BRANCHES: thin and flexible with dark bands



Rocknettle

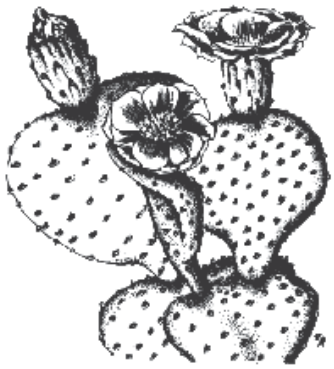
Eucnide urens

Bristly, broad-leaved shrub of canyons and washes.

LEAVES: large for a desert plant; bright green color almost hidden by stiff bristles

FLOWERS: pale yellow and showy

WARNING: avoid touching this plant, the bristles will cling to clothing and are irritating to the skin



Beavertail Cactus

Opuntia basilaris

A low growing pricklypear cactus lacking long spines.

STEMS: flat gray-green pads dotted with bunches of tiny spines

FLOWERS: magenta and showy

WARNING: although this cactus appears spine-free, do not touch; the small, barbed spines are very irritating to the skin

Arrowweed

Pluchea sericea

These water-loving shrubs form the "corn shocks" of the Devil's Cornfield.

LEAVES: gray-green; narrow and pointed

FLOWERS: pink clusters

STEMS: long and straight like arrow shafts; grow in thick clumps

Turtleback

Psathyrotes ramosissima

Low, compact plant of dry washes.

LEAVES: gray, wrinkled, and furry; very aromatic.

FLOWERS: yellow clusters at any season

Honeysweet

Tidestromia oblongifolia

Rounded, low shrub, often found with desert holly.

LEAVES: gray-green, tiny and covered with fuzz; turns pink, then tan, in winter when dormant

STEMS: abundant, pink tinged branches make plant compact and rounded

Pickleweed

Allenrolfea occidentalis

Succulent shrub of salty springs. Our most salt tolerant plant.

STEMS: fleshy and green; numerous joints like pearls on a string; turn rusty-red in winter when dormant.

Desert Wildlife

Death Valley National Park

bighorn sheep

Shy and elusive, bighorn sheep are the park's largest native animal. Watch for them in canyons and on mountain slopes.

kit fox

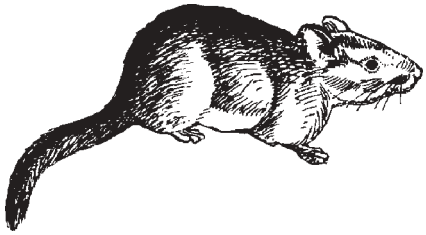
Kit fox are the size of a housecat and have large ears and tail. They are nocturnal and are most common in lower elevations.

coyote

Common throughout the park. Coyotes are excellent scavengers and hunters; they do no need your handouts. **Do not feed coyotes or other wildlife!**

antelope ground squirrel

These tiny, pale squirrels are common in the desert shrublands. White tail is held over its back to reflect sunlight.



desert woodrat

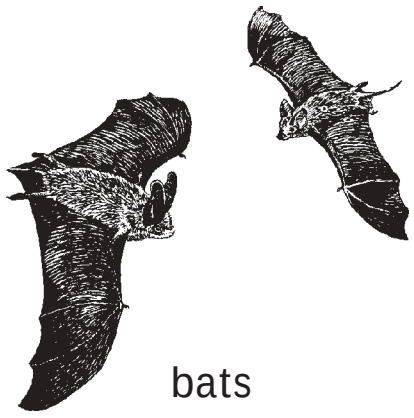
Also known as pack rats, these nocturnal rodents love to collect things and pile them in their middens.

kangaroo rat

Nocturnal kangaroo rats are found in dry areas on the valley floor, especially near mesquite.

black-tailed jackrabbit

Jackrabbits are most common in the mid-elevations around the park. Watch for them on moon-lit nights.



bats

Bats are usually seen at dusk. The most common species found in the park are the California myotis and the western pipistrelle.

pupfish

Tiny native pupfish are found in only a few isolated springs and creeks. Four species live in the park; the Devil's Hole pupfish is an endangered species.

roadrunner

These ground-dwelling desert birds are found in the lower elevations of Death Valley. They eat lizards, insects, snakes, and small birds.

great-tailed grackle

These sleek birds are often found in noisy flocks near developed areas. Males are glossy-black with long tails; the brown females have shorter tails.

raven

Ravens are common throughout the park and are often found in pairs. These clever birds eat a great variety of food.

chuckwalla

Chuckwallas are the largest lizard in the park. Found near rocks, it will squeeze into a rock crevice and inflate itself when threatened.

horned lizard

Well camouflaged, these lizards are often found near ants, their primary food source. Watch for them crossing dirt roads in the park's mid-elevations.

zebra-tailed lizard

These pale lizards are common in the lower elevations of the valley. They lift their black and white striped tails high when running.

sidewinder

These rattlesnakes are found mainly in the lower elevations. Though venomous, sidewinders are not agressive when left undisturbed.

scorpion

Scorpions are nocturnal and hide under rocks from the desert sun. All scorpions have a venomous sting, but those found in the park are not deadly.

tarantula

These harmless, ground-dwelling spiders are most often seen crossings roads in autumn. Look for them in the higher desert valleys.

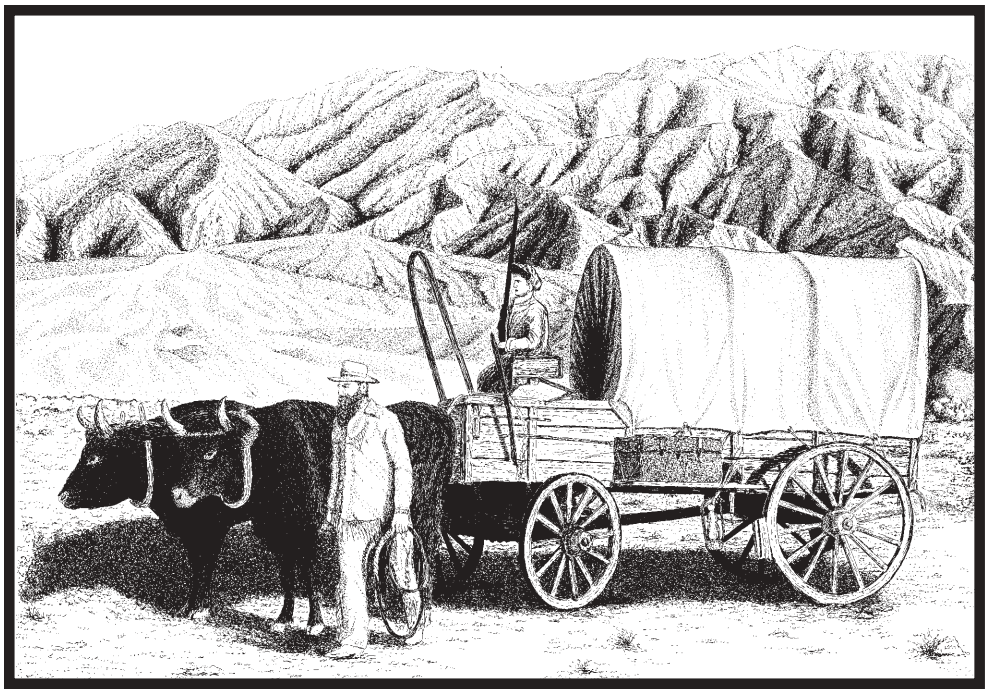
rev.3/02

Lost '49ers

Death Valley National Park

The Forty-niners

In 1849, gold was discovered at Sutter's Mill in California and a rush began into the state. It is estimated that 80,000 people came to California looking for gold in 1850. One such group set out from Salt Lake City, Utah in over 100 wagons under the leadership of Capt. Jefferson Hunt. These families and bands of bachelors came from the South and Midwest. One small group of men came from Germany. As the party progressed along the trail, dissension mounted when a man produced a shortcut map. Capt. Hunt refused to follow the shortcut because he wasn't familiar with the route. All but seven wagons broke away to follow the map. Most wagons later rejoined Capt. Hunt, but the rest of the party continued on the purported route.



Across Death Valley

Eventually they realized the map was in error when they found themselves in uncharted territory. Indians watched silently as these strangers traversed their land. The emigrants arrived in December. As they were travelling along, they split up. The young bachelors went one way and discouraged families from following them thinking they would slow them down. But the Reverend Brier, his wife, Julia and their three children aged eight, six, and four years, insisted on following the young men. For two months they wandered through Death Valley. At one point they went for 48 hours without anything to drink. Perilously close to starving to death, they had to slay their oxen and leave their wagons behind. By the time they left Death Valley, the Brier's oldest son was the weight of a 3 year old.

Good-bye, Death Valley

Another lost party, the Bennett, Arcane and Wade families had taken a different route. The Wade family, travelling behind the others, were the only ones to find their way out of Death Valley with their wagons intact. The Bennett and Arcane families felt they could not go on after suffering terrible hardships. Two young bachelors travelling with them, William Manley and John Rogers, travelled out of Death Valley on foot and came back with food and supplies to rescue the others. Legend has it that one member of the party turned back and said "good-bye Death Valley". In truth, only one man in the entire group of lost forty-niners perished within Death Valley. However, the ominous name stuck. Reporters began telling gruesome stories about the place. It was said that beasts conjured up by Satan ruled the area and a poison gas would kill anyone who ventured into the barren terrain.

The Next Chapter

As gold, silver, borax and other minerals were discovered in Death Valley the stories lost their ability to scare people away. Ironically, almost all of the men who had been lost in Death Valley in 1849 returned to look for the gold and silver potential they had seen here during the nightmare of their ordeal.

rev. 2/02

Mining in Death Valley

Death Valley National Park

Since the 1848 discovery of gold in California, Death Valley has experienced over 130 years of boom and bust mining. From the 1880s to early 1900s mining was limited and sporadic in the Death Valley region. Many of these early mining districts met with a notable lack of success. Primitive and inefficient technology, scarcity of water and fuel, and the difficulties of transportation made it economically impossible to mine any but the highest grade ores.

One of the earliest successful mining operations was the Harmony Borax Works, which was active from 1883 to 1888. This mill was famous not for its ore deposits, but for the Twenty Mule Team wagons used to transport the partially refined borax. A very memorable advertising campaign used the wagons' image to promote the company's Boraxo soap and the Death Valley Days radio and television programs.

With renewed interest in gold and silver mining, the early 1900s witnessed new mines. Skidoo, Rhyolite, and Keane Wonder became large-scale operations. The boom towns which sprang up around these mines flourished during the first decade of the 20th century but soon slowed down after the panic of 1907. Besides searching for gold and silver, prospectors scoured the mountains for antimony, copper, lead, zinc, and tungsten. Prosperous large-scale metal mining in Death Valley ended around 1915.

In February 1933 President Herbert Hoover signed the proclamation creating Death Valley National Monument. This resulted in a temporary closing of monument lands to prospecting and the filing of new mining claims. By prior agreement the monument was quickly reopened to prospecting and mining by Congressional action in June of the same year.

As improvements in mining technology allowed lower grades of ore to be processed and new heavy equipment allowed greater amounts of rock to be moved, mining in Death Valley changed. Gone were the days of the "single-blanket, jackass prospector" long associated with the romantic west. Open-pit and strip mines began to scar the landscape as internationally-owned mining corporations bought claims in highly visible locations of the national monument. The public outcry that ensued led to greater protection for all national park areas.

Congress passed the Mining in the Parks Act in 1976 which closed Death Valley National Monument to the filing of new mining claims, banned open-pit mining and required the National Park Service to examine the validity of thousands of pre-1976 mining claims. Mining was allowed to resume on a limited basis in 1980 with stricter environmental standards. Mine operators are required to get approval of a Plan of Operations which should mitigate damage to the environment.

Death Valley National Park was established in 1994, enlarging the park by 1.3 million acres. The park also assumed jurisdiction over hundreds of additional unpatented mining claims.

For over a decade the Billie Mine, an underground borax mine along the road to Dante's View, was the only active mine in the park. In 2005 when the Billie Mine closed, the last of Death Valley's mines had ceased operations.

The park's Resources Management Division continues to review the status of 38 unpatented mining claims and 19 patented claim groups while insuring that federal guidelines are followed and the park's resources are being protected.

Keane Wonder Mine

Borax: History & Uses

Death Valley National Park

Borax belongs to a group of boron minerals called borates resembling quartz crystals, fibrous cottonballs or earthy white powders. They originated in hot springs or vapors associated with the outpouring of volcanic rocks such as the colorful formations of Artists Drive. Seeping groundwater formed glassy borate veins in the extinct lakebeds of Furnace Creek and has moved soluble borates to modern salt flats such as the floor of Death Valley. There, evaporation has left a mixed white crust of salt, borax and alkalies.

The history of borax in America began in earnest with the borax boom of the 1870s, when many California and Nevada salt flats were claimed by prospectors. One was Aaron Winters, who used the famous green-flame test to locate borax on a Death Valley salt marsh in 1881. His claims were soon purchased by W.T. Coleman, builder of Harmony Borax Works, where marsh muds were refined until 1889. The contemporary Eagle Borax Works folded in 1882 because of poor deposits, summer heat and remoteness. Coleman's company beat the heat by moving summer operation to the Amargosa Works near less-torrid Shoshone. The transportation problem was solved by hitching 20-mule teams to gigantic borax wagons with a payload in tandem of over 20 tons.

By 1890, salt marsh operations were obsolete and F.M. "Borax" Smith consolidated most claims in the Pacific Coast Borax Company. He concentrated on mining glassy veins of a rich new borate in the Calico Mountains, south of Death Valley. Not until 1907 did this same new mineral, colemanite, bring the miners back to Death Valley to honeycomb the Greenwater Range--first at the Lila C. Mine and after 1914 at Ryan. From 1928 to 1971 Death Valley borax was again in mothballs while more profitable deposits were worked at Boron and Searles Lake (Trona). Two open-pit mines near Ryan were worked in the 1970s. The Billie Mine, which is underground, is presently the only active borax mining operation in the Death Valley area.

The Borax Museum at the Furnace Creek Ranch highlights minerals and mining equipment. Visit the ruins of Harmony Borax Works to relive this colorful phase of Death Valley's past.

Uses of Borax: Ceramic industries use nearly half of America's borax in producing pottery glazes, china and porcelain enamel. Heat-resistant borosilicate glass goes into ovenware, lenses and fiberglass. As a flux and deoxidizer, borax is used in welding, soldering, brazing, smelting and refining metals. As a mild antiseptic, it is used in disinfectants, gauze, salves and eyewash. It is also a mold-retarding wash on citrus fruits, leathers and textiles. It is a preservative in cosmetics, glues and foods.

As solvents and emulsifiers, borax solutions are used in manufacturing coated papers, playing cards, plywood, plaster, paint and leathers. In fertilizers it prevents boron-deficiency diseases of celery, turnips, apples, tobacco, sugar beets and alfalfa. In high concentrations it is a weed killer and insecticide.

Boron-steel alloys go into armor plate. A new boron fiber developed by the space program is lighter than aluminum but stronger than steel. Boron carbide for cutting tools is an abrasive second only to diamonds in hardness. Additional uses of borates include gasoline additives, photo developers, rocket fuels, buffers in electroplating solutions, corrosion inhibitors in antifreeze, fire retardants chemical (borax bead) tests, and dye stabilizers.

rev. 2/02

Harmony Borax Works 1885